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S1D13L02 LCD controller

S5U13L02P00C100 Evaluation Board User Manual

SEIKO EPSON CORPORATION

Rev. 1.0

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3. The part used for this evaluation board/kit or development tool may be changed without any notice.

NOTICE

Table of Contents

Chapter 1 Introduction

This manual describes the setup and operation of the S5U13L02P00C100 Evaluation Board. The evaluation board is designed as an evaluation platform for the S1D13L02 LCD controller.

The S5U13L02P00C100 Evaluation Board can also connect to the S5U13U00P00C100 USB Adapter board so that it can be used with a laptop or desktop computer, via USB 2.0. The S5U13L02P00C100 Evaluation Board can be used with many native platforms via the host connector which provides the appropriate signals to support a variety of CPUs. However, if you do not use the S5U13U00P00C100 USB Adapter board, there are no headers mounted for the other host interfaces. (there are unpopulated spaces allocated for headers.) Please use the allocated space to mount the headers to use other host interfaces.

This user manual is updated as appropriate. Please check the Epson Electronics America Website at vdc.epson.com for the latest revision of this document before beginning any development.

We appreciate your comments on our documentation. Please contact us via email at documentation@eea.epson.com.

Chapter 2 Features

The S5U13L02P00C100 Evaluation Board includes the following features:

- 208-pin QFP22 S1D13L02 LCD controller
- Headers for connection to the S5U13U00P00C100 USB Adapter board
- Header with all S1D13L02 Host Bus Interface signals (optional)

Note
These headers are not mounted. There are allocated spaces for the headers.

- Headers for connecting to LCD panels
- Header for S1D13L02 GPIO pins (optional)

Note
These headers are not mounted. There are allocated spaces for the headers.

- On-board 4MHz oscillator
- 3.3V input power
- On-board voltage regulator with 1.5V output
- On-board voltage regulator with adjustable 38V/60mA max, to provide power for LED back-light of LDC panels.

Chapter 3 Installation and Configuration

The S5U13L02P00C100 Evaluation Board incorporates a DIP switch, jumpers, and 0 ohm resistors which allow it to be used with a variety of different configurations.

3.1 Configuration DIP Switch

The S1D13L02 has 2 configuration inputs (CNF[2:1]). A DIP switch (SW1) is used to configure CNF[2:1] as described below.

Table 3-1: Configuration DIP Switch Settings

S5U13L02P00C100 SW1-[2:1] Config	S1D13L02 CNF[2:1] Config	Power-On/Reset State	
		1 (ON)	0 (OFF)
SW1-[2]	CNF2	Big Endian	Little Endian
SW1-[1]	CNF1	Indirect 68	Indirect 80

= Required settings when using S5U13U00P00C100 USB Adapter board

The following figure shows the location of DIP switch SW1 on the S5U13L02P00C100 Evaluation Board.

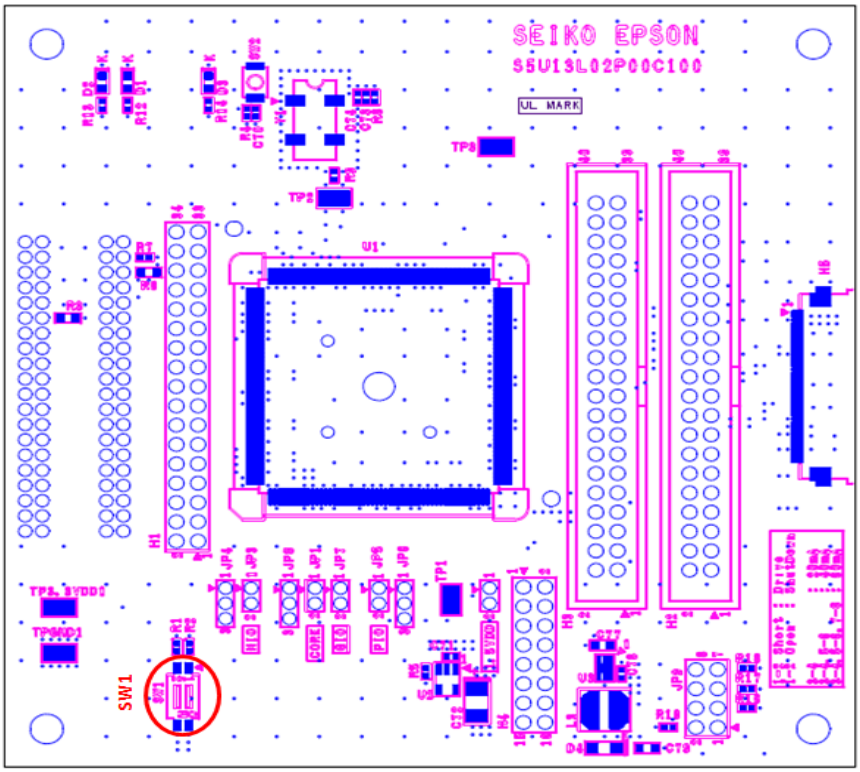

Figure 3-1: Configuration DIP Switch (SW1) Location

3.2 Configuration Jumpers

The S5U13L02P00C100 Evaluation Board has 2-pin jumpers (x 8) which configure various board settings. And this board has 8-pin jumper for setting backlight of the LCD panel. The jumper positions for each function are shown below.

Table 3-2: Configuration Jumper Settings

Jumper	Function	Position 1-2	Position 2-3	No Jumper
JP1	COREVDD	Normal	—	COREVDD current measurement
JP2	PLLVDD	Normal	—	PLLVDD current measurement
JP3	HIOVDD	Normal	—	HIOVDD current measurement
JP4	HIOVDD Source	H1 connector, pin 32	3.3VDD	—
JP5	PIOVDD	Normal	—	PIOVDD current measurement
JP6	PIOVDD Source	H4 connector, pin 2	3.3VDD	—
JP7	GIOVDD	Normal	—	GIOVDD current measurement
JP8	GIOVDD Source	H4 connector, pin 6	3.3VDD	—

= Required settings when using S5U13U00P00C100 USB Adapter board

Table 3-3: 8-PinJumper Setting

Jumper	Position		Function
JP9	Position 1-2	No Jumper	In connect case, TPS61161A is Enable
	Position 3-4	No Jumper	In connect case, Vout = 20mA
	Position 5-6	No Jumper	In connect case, Vout = 40mA (add connect Position 3-4)
	Position 7-8	No Jumper	In connect case, Vout = 60mA (add connect Position3-4 and Position5-6)

= suggested settings

JP1, JP2, JP3, JP5, JP7 - Power Supplies for the S1D13L02

JP1, JP2, JP3, JP5, and JP7 can be used to measure the current consumption of each S1D13L02 power supply. When the jumper is at position 1-2, normal operation is selected.
When no jumper is installed, the current consumption for each power supply can be measured by connecting an ammeter to pin 1 and 2 of the jumper.

The jumper associated with each power supply is as follows:

JP1 for COREVDD
JP2 for PLLVDD
JP3 for HIOVDD
JP5 for PIOVDD
JP7 for GIOVDD

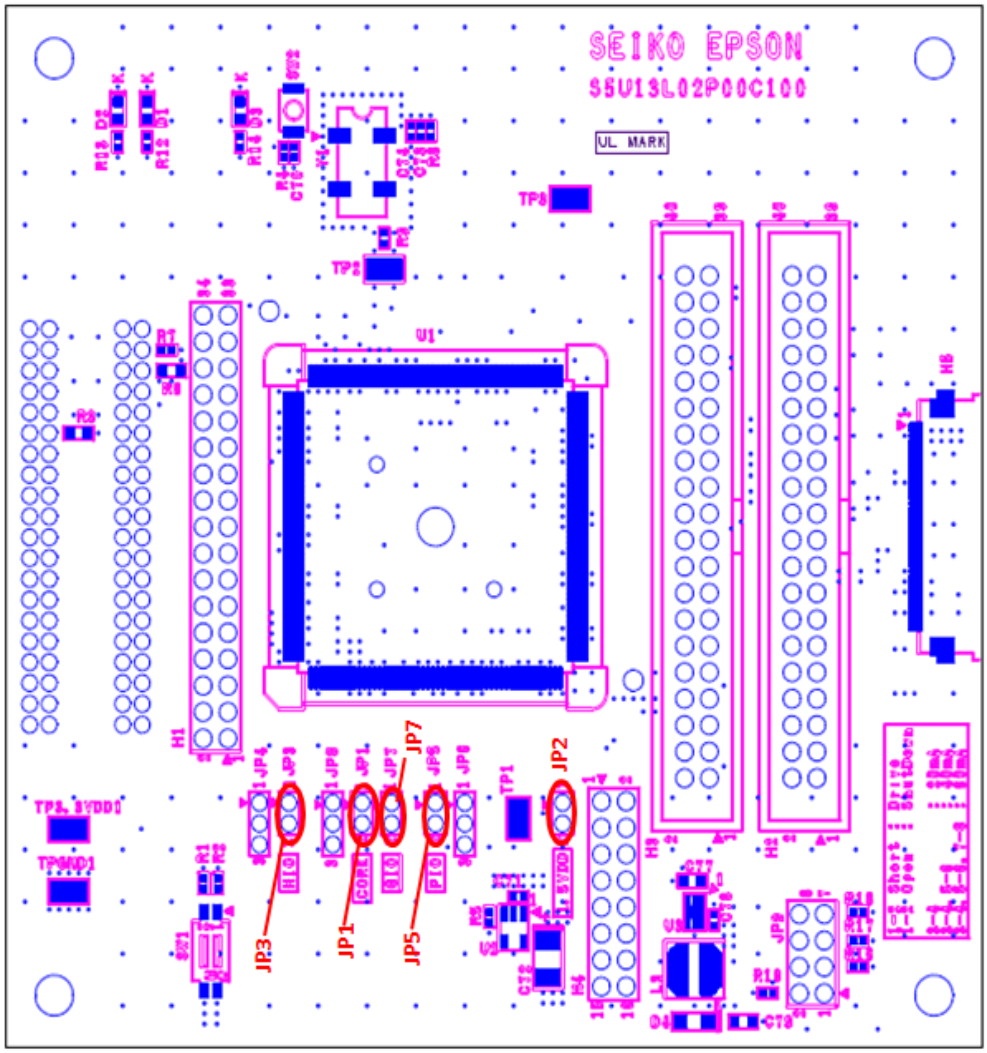

Figure 3-2: Configuration Jumper Locations (JP1, JP2, JP3, JP5, JP7)

JP4 - HIOVDD Source

JP4 is used to select the source for the HIOVDD supply voltage.
When the jumper is at position 1-2, the HIOVDD voltage must be provided to pin 32 on the H1 connector.
When the jumper is at position 2-3, the HIOVDD voltage is provided by the 3.3V power supply of the board.

Note
HI connector is not mounted. There is allocated space for the connector.

JP6 - PIOVDD Source

JP6 is used to select the source for the PIOVDD supply voltage.
When the jumper is at position 1-2, the PIOVDD voltage must be provided to pin 2 on the H4 connector.
When the jumper is at position 2-3, the PIOVDD voltage is provided by the 3.3V power supply of the board.

Note
H4 connector is not mounted. There is allocated space for the connector.

JP8 - GIOVDD Source

JP8 is used to select the source for the GIOVDD supply voltage.
When the jumper is at position 1-2, the GIOVDD voltage must be provided to pin 6 on the H4 connector.
When the jumper is at position 2-3, the GIOVDD voltage is provided by the 3.3V power supply of the board.

Note
H4 connector is not mounted. There is allocated space for the connector.

JP9 - Backlight Power Supply for LCD Panel

The S5U13L02P00C100 Evaluation Board is designed to generate backlight power supply for LCD panel from 3.3V via the S5U13U00P00C100 USB adapter board or connector H1. The 3.3V must be supplied from the S5U13U00P00C100 or H1. The S5U13L02P00C100 has incorporated the White LED Driver Controller (TPS61161A) for the panel backlight. The White LED Driver Controller drives the panel at a constant current. The S5U13L02P00C100 is capable of changing the output current (20mA, 40mA, 60mA/Max38V).The current is adjusted by connection of JP9.See Table 3.3: 8-pin jumper setting”“

Note
H1 connector is not mounted. There is allocated space for the connector.

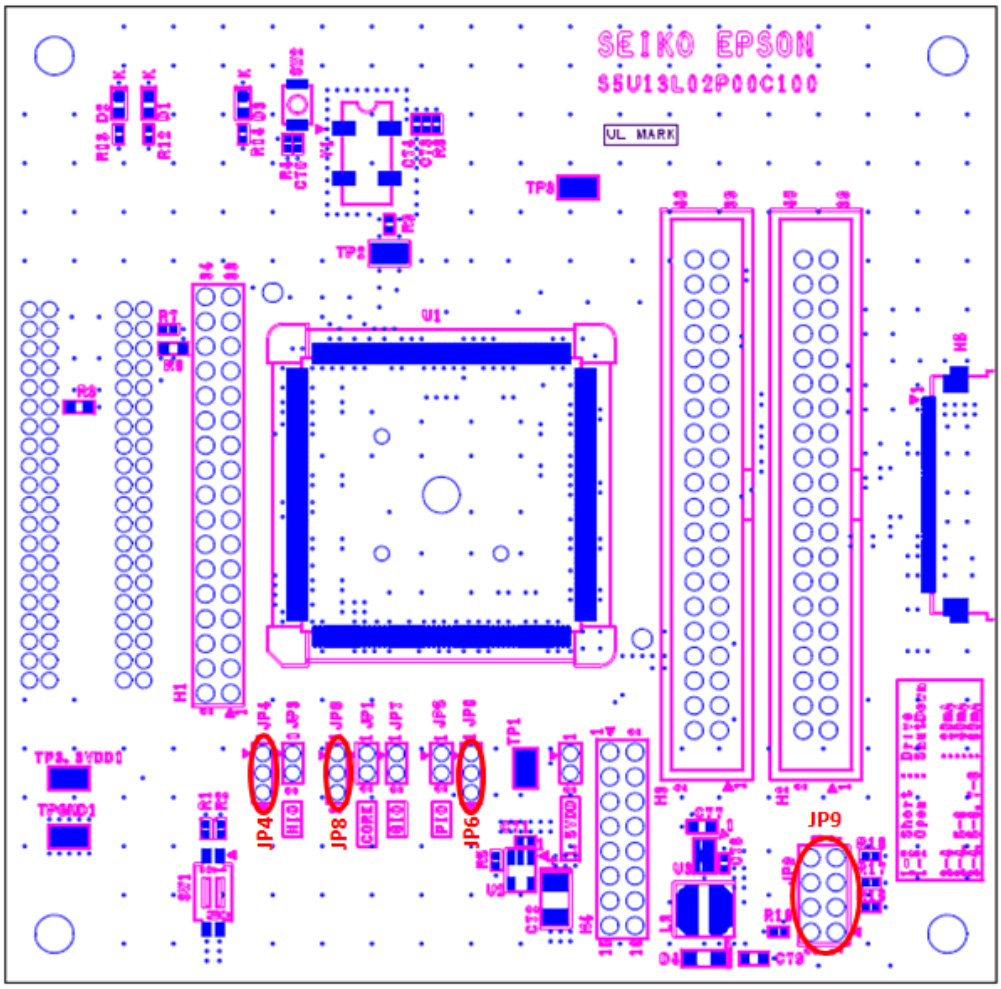

Figure 3-3: Configuration Jumper Location (JP4, JP6, JP8, JP9)

Chapter 4 Technical Description

4.1 Power

4.1.1 Power Requirements

The S5U13L02P00C100 Evaluation Board requires an external regulated power supply (3.3V / 1A). The power is supplied to the evaluation board through pin 34 of the H1 header, or pin 5 of the P2 header.

The green LED “3.3V Power” is turned on when 3.3V power is applied to the board.

Note
H1 connector is not mounted. There is allocated space for the connector.

4.1.2 Voltage Regulators

The S5U13L02P00C100 Evaluation Board has an on-board linear regulator to provide the 1.5V power required by the S1D13L02 LCD controller. It also has a step-up switching voltage regulator to generate adjustable 12~38V, which can be used to power the LED backlight on some LCD panels.

4.1.3 S1D13L02 Power

The S1D13L02 LCD controllerrequires 1.5V and 1.65~3.6V power supplies.

1.5V power for COREVDD and PLLVDD is provided by an on-board linear voltage regulator.

HIOVDD range of S1D13L02 isfrom 1.65V to 3.6V. However, HIOVDD of the S5U13L02P00C100 Evaluation Board can range from 3.0V to 3.6V. When JP4 is set to the 2-3 position, HIOVDD is connected to 3.3V. If a different voltage is required for HIOVDD, set JP4 to the 1-2 position and connect the external power supply to pin 32 of connector H1.

Note
H1 connector is not mounted. There is allocated space for the connector.

PIOVDD of S1D13L02 is the power used by the LCD interface and GPIO[23:8] and can range from 1.65V to 3.6V. However, PIOVDD of the S5U13L02P00C100 Evaluation Board can range from 3.0V to 3.6V. When JP6 is set to the 2-3 position, PIOVDD is connected to 3.3V. If a different voltage is needed for PIOVDD because of the LCD panel requirements, set JP6 to the 1-2 position and connect the external power supply to pin 2 of connector H4.

Note
H4 connector is not mounted. There is allocated space for the connector.

GIOVDD of S1D13L02 is the power used by GPIO[7:0] and can range from 1.65V to 3.6V. However, PIOVDD of the S5U13L02P00C100 Evaluation Board can range from 3.0V to 3.6V. When JP8 is set to the 2-3 position, GIOVDD is connected to 3.3V. If a different voltage is needed for GIOVDD, set JP8 to the 1-2 position and connect the external power supply to pin 6 of connector H4.

Note
H4 connector is not mounted. There is allocated space for the connector.

4.2 Clocks

The clock for the S1D13L02 LCD controlleris provided by a 4MHz oscillator.

Note
The on-board 4MHz oscillator is not specified to work below a 3.0V supply voltage.

4.3 Reset

The S1D13L02 LCD controlleron the S5U13L02P00C100 Evaluation Board can be reset using a push-button switch (SW2), or via an active low reset signal from the host development platform (pin 33 on the H1 connector).

Note
H1 connector is not mounted. There is allocated space for the connector.

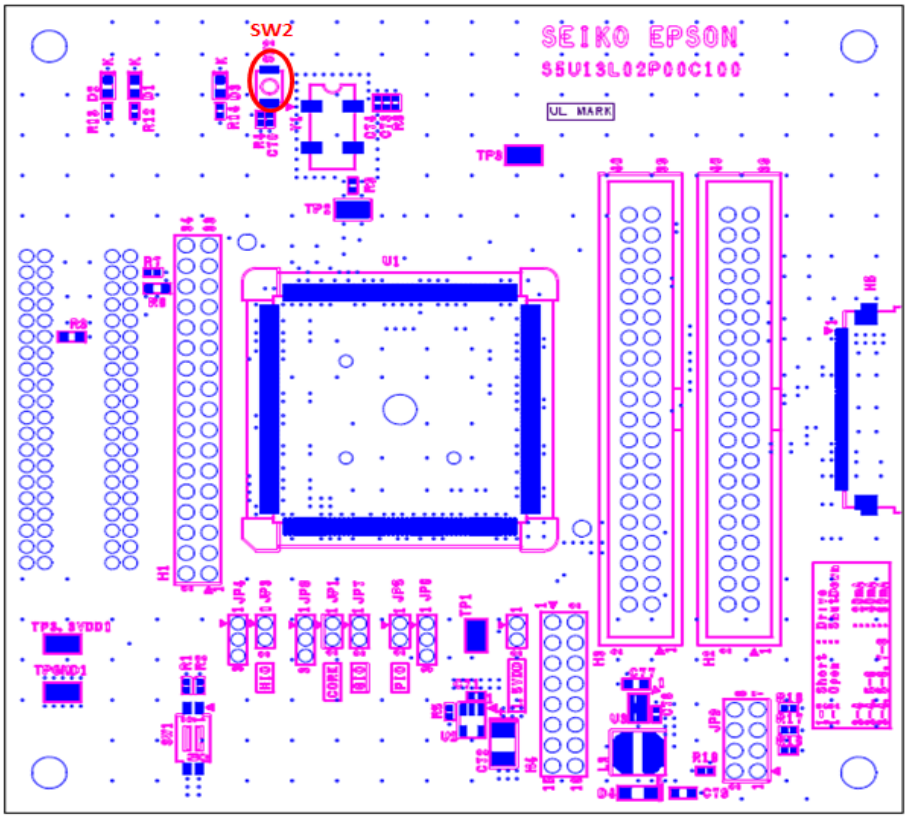

Figure 4-1: Reset Switch (SW2)

4.4 Host Interface

4.4.1 Direct Host Bus Interface Support

All S1D13L02 host interface pins are available on connector H1 which allows the S5U13L02P00C100 Evaluation Board to be connected to a variety of development platforms. For detailed S1D13L02 pin mapping, refer to the *S1D13L02 Hardware Functional Specification*, document number XB0AA001.

The following figure shows the location of host bus connector H1. H1 is not mounted. H1 connector is optional. There is allocated space for the connector. If to use this allocated space , it is recommended to attach the 0.1 inch x 0.1 inch, 34-pin header (17 x 2).

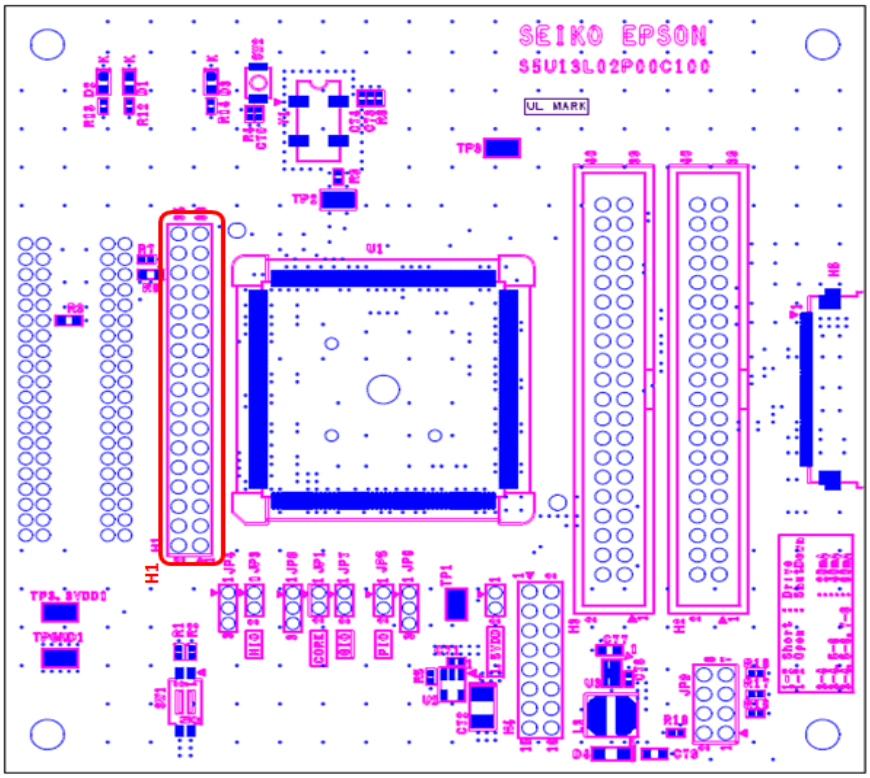

Figure 4-2: Host Bus Connector Location (H1)

For the pinout of connector H1, see Section Chapter 6, “Schematic Diagrams” on page 20.

4.4.2 Connecting to the Epson S5U13U00P00C100 USB Adapter Board

The S5U13L02P00C100 Bvaluation Board is designed to connect to a S5U13U00P00C100 USB Adapter Board. The USB adapter board provides a simple connection to any computer via a USB 2.0 connection. The S5U13L02P00C100 directly connects to the USB adapter board through connectors P1 and P2.

The USB adapter board also supplies the 3.3V power required by the S5U13L02P00C100. HIOVDD should be selected for 3.3V and JP4 should be set to the 2-3 position.

When the S5U13L02P00C100 is connected to the S5U13U00P00C100 USB Adapter board, there are 2 LEDs on the S5U13L02P00C100 which provide a quick visual status of the USB adapter. HB (D300)blinks to indicate that the USB adapter board is active. ENUM (D301)turns on to indicate that the USB has been enumerated by the PC.

The following diagram shows the location of connectors P1 and P2. P1 and P2 are 2mm x 2mm, 40-pin headers (20 x 2).

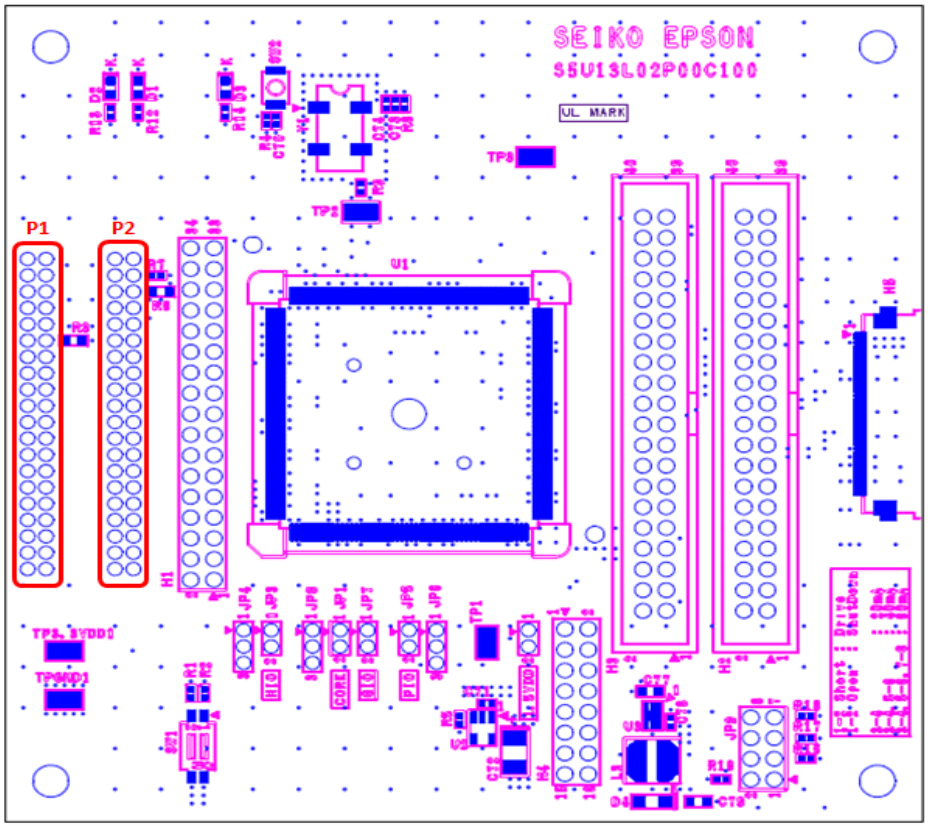

Figure 4-3: USB Adapter Connector Locations (P1 and P2)

For the pinout of connectors P1 and P2, see Section Chapter 6, “Schematic Diagrams” on page 20.

Note
A windows driver must be installed on the PC when the S5U13L02P00C100 is used with the S5U13U00P00C100 USB Adapter Board. The S1D13xxxUSB driver is available vdc.epson.com.

4.5 LCD Panel Interface

The LCD interface signals are available on connectors H2, H3 and H5.

For S1D13L02 LCD interface pin mapping, refer to the *S1D13L02 Hardware Functional Specification*, document number XB0A-A-001.

Connectors H2and H3 are 0.1” x 0.1”, 40-pin headers (20 x 2). Connector H5 is 0.5mm pitch, 40-pin FPC connector. The following diagram shows the location of connectors H2, H3,and H5.

Note
Connector H2 and H3 are not mounted. H2 and

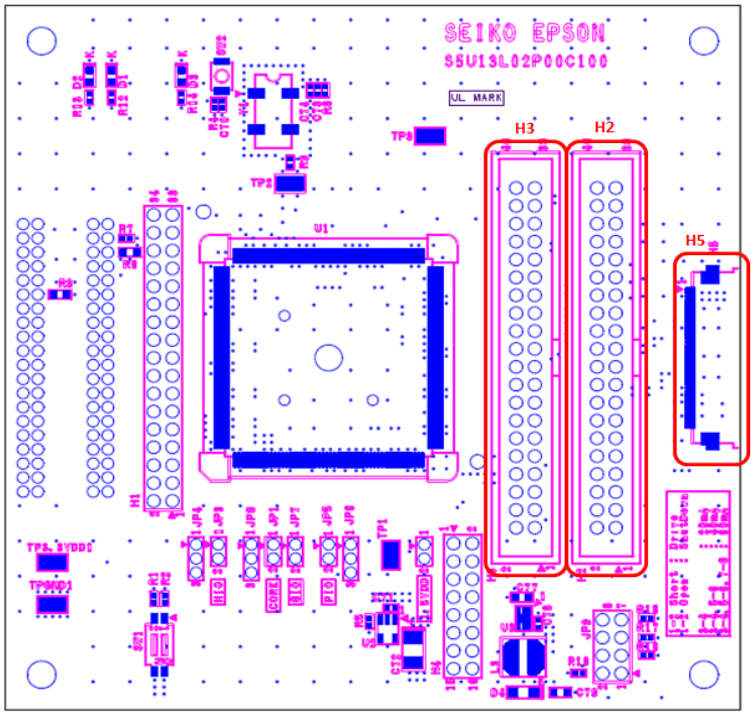

Figure 4-4: LCD Panel Connectors Location (H2, H3, H4)

For the pinout of connectors H2, H3,H4 and H5, see Section Chapter 6, “Schematic Diagrams” on page 20.

4.6 GPIO Connections

The S1D13L02 LCD controllerhas 24 GPIO pins. The GPIO[23:8] pins have dual functions and are selectable between a LCD output or GPIO function. They are powered from PIOVDD. For S1D13L02 LCD interface pin mapping, refer to the *S1D13L02 Hardware Functional Specification*, document number XB0A-A-001.

The GPIO[7:0] pins only function as GPIOs and are powered from GIOVDD. All the GPIO pins are available on the H3 and H4 connectors. Note that connector H4 is not populated on the S5U13L02P00C100 Evaluation Board.

Connector H3 is a 0.1” x 0.1”, 40-pin header and connector H4 is a 0.1” x 0.1”, 16-pin header (8 x 2). The following figure shows the location of the connector H3 and H4.

Note
Connector H3 and H4 are not mounted. There is only allocated sapce for the connectors. H3 and

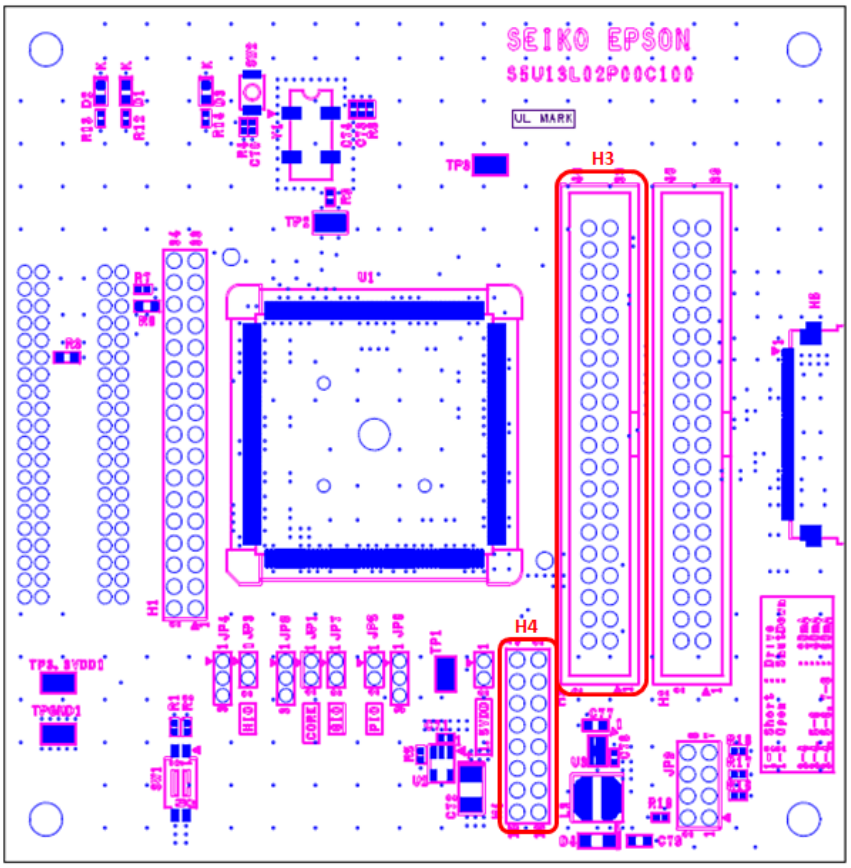

Figure 4-5: GPIO Connector Location (H3, H4)

For the pinout of connector H3 and H4, see Section Chapter 6, “Schematic Diagrams” on page 20.

Chapter 5 Parts List

Table 5-1: S5U13L02P00C100 Parts List

Item	Qty	Reference	Part	Description	Manufacturer Part No
1	38	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C27, C30, C31, C32, C33, C34, C35, C36, C37, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C66, C67, C70, C71, C73,C78	0.1uF	C0402	Yageo America 04022F104Z7B20D
2	34	C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C38, C39, C40, C41, C42, C43, C44, C45, C56, C57, C58, C59, C60, C61, C62, C63, C64, C65, C68, C69, C74	0.01uF	C0402	Kemet C0402C103K4RACTU
3	1	C28	1nF	C0402	Yageo America 04022R102K9B20D
4	1	C29	10uF	C0805	Panasonic - ECG ECJ-CV50J106M
5	1	C72	4.7uF 10V T	CAPACITOR TANT 4.7UF 10V 10% SMD C3528	Kemet T494B475K010AT
6	1	C77			
7	1	C79	1uF 35V		
8	3	D1, D2, D3		LED GREEN LED0603	ROHM SML-310VTT86
9	1	D4	MBR0540	CSR04	TOSHIBA CRS04
10	0	H1	Host Connector	not mounted	Samtec TSW-117-07-G-D
11	0	H2, H3	LCD Connector	not mounted	Samtec TST-120-01-G-D
12	0	H4	GPIO Connector	not mounted	Samtec TSW-108-07-G-D
13	5	JP1, JP2, JP3, JP5, JP7		CONN HEADER VERT 2POS .100 TIN or GENERIC SIP2	
14	3	JP4, JP6, JP8		CONN HEADER VERT 3POS .100 TIN or GENERIC SIP3	
15	1	JP9	LCD backlight Connector	Pin Header 2.54mm 4x2	67997-108HLF
16	2	L1, L2	Ferrite	FERRITE 200MA 938 OHMS 0603 SMD R0603	Steward HZ0603B751R-10
17	1	L3	22uH	Fixed inductor	TDK VLCF5020T-220MR75-1
18	2	P1, P2	HEADER_20X2	HDR2X20/2MM	3M 151240-8422-RB
19	3	R1, R2, R19	10k	R0402	
20	2	R3, R6	0	R0603	
21	1	R4	150k 1%	R0402	
22	3	R5, R7, R8	0	R0402	

Table 5-1: S5U13L02P00C100 Parts List (Continued)

Item	Qty	Reference	Part	Description	Manufacturer Part No
23	1	R9	33 1%	R0402	
24	3	R12, R13, R14	330	R0402	
25	3	R16, R17, R18	56k	R0402	
26	12	SH1, SH2, SH3, SH4, SH5, SH6, SH7, SH8, SH9, SH10, SH11, SH12	.100 in. Jumper Shunt	JUMPER SHORTING TIN	Sullins Electronics Corp. STC02SYAN
27	1	SW1	SW2_DIPSW2	SWITCH DIP HALF PITCH 2POS DIPSW2	CTS Corp 218-2LPST
28	1	SW2			ALPS SKRKAEE010
29	2	TPGND1, TP3.3VDD1	TP_SMT	PC TEST POINT MINIATURE SMT TP_1206	Keystone 5015
30	1	U1	S1D13L02	LCD controller	Epson
31	1	U2	TPS76915DBVT	IC 1.5V 100MA LDO REG SOT-23-5	Texas Instruments TPS76915DBVT
32	1	U3	TPS61161ADRVT		Texas Instruments TPS61161ADRVT
33	1	Y1	4M OSC	OSC 4.0000MHz 3.3V 50ppm SMD	EPSON SG-636

Chapter 6 Schematic Diagrams

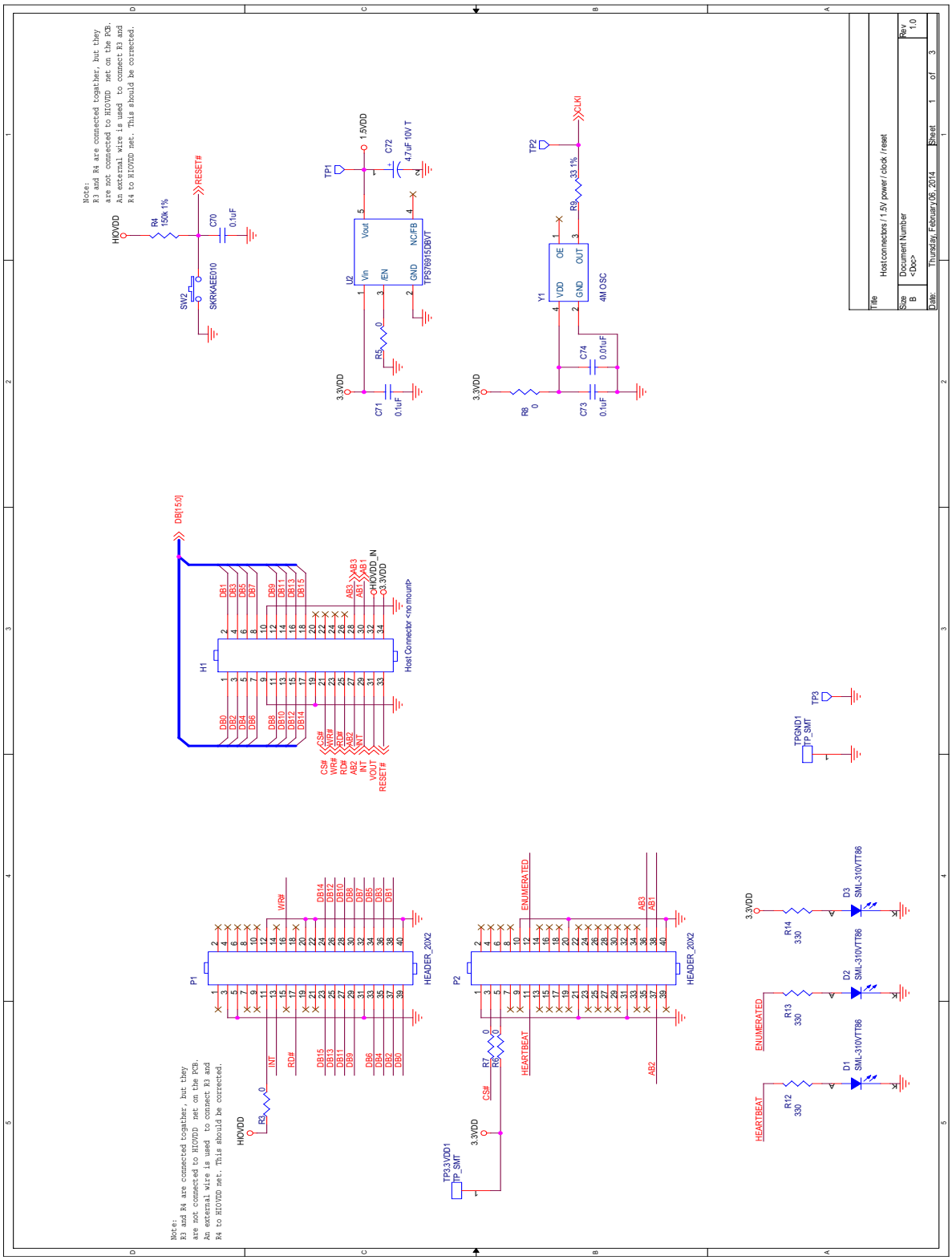

Figure 6-1: S5U13L02P00C100 Schematics (1 of 3)

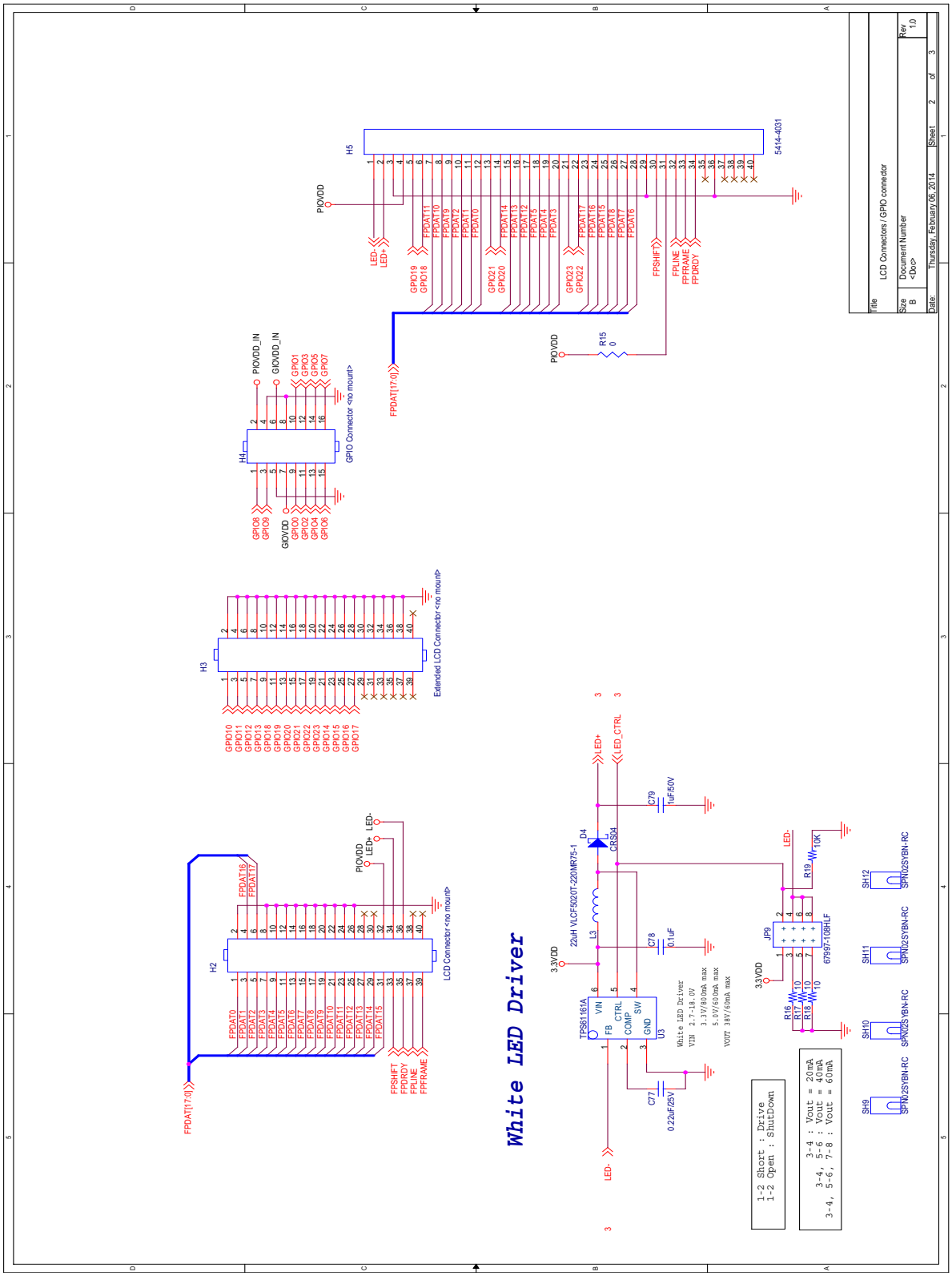

Figure 6-2: S5U13L02P00C100 Schematics (2 of 3)

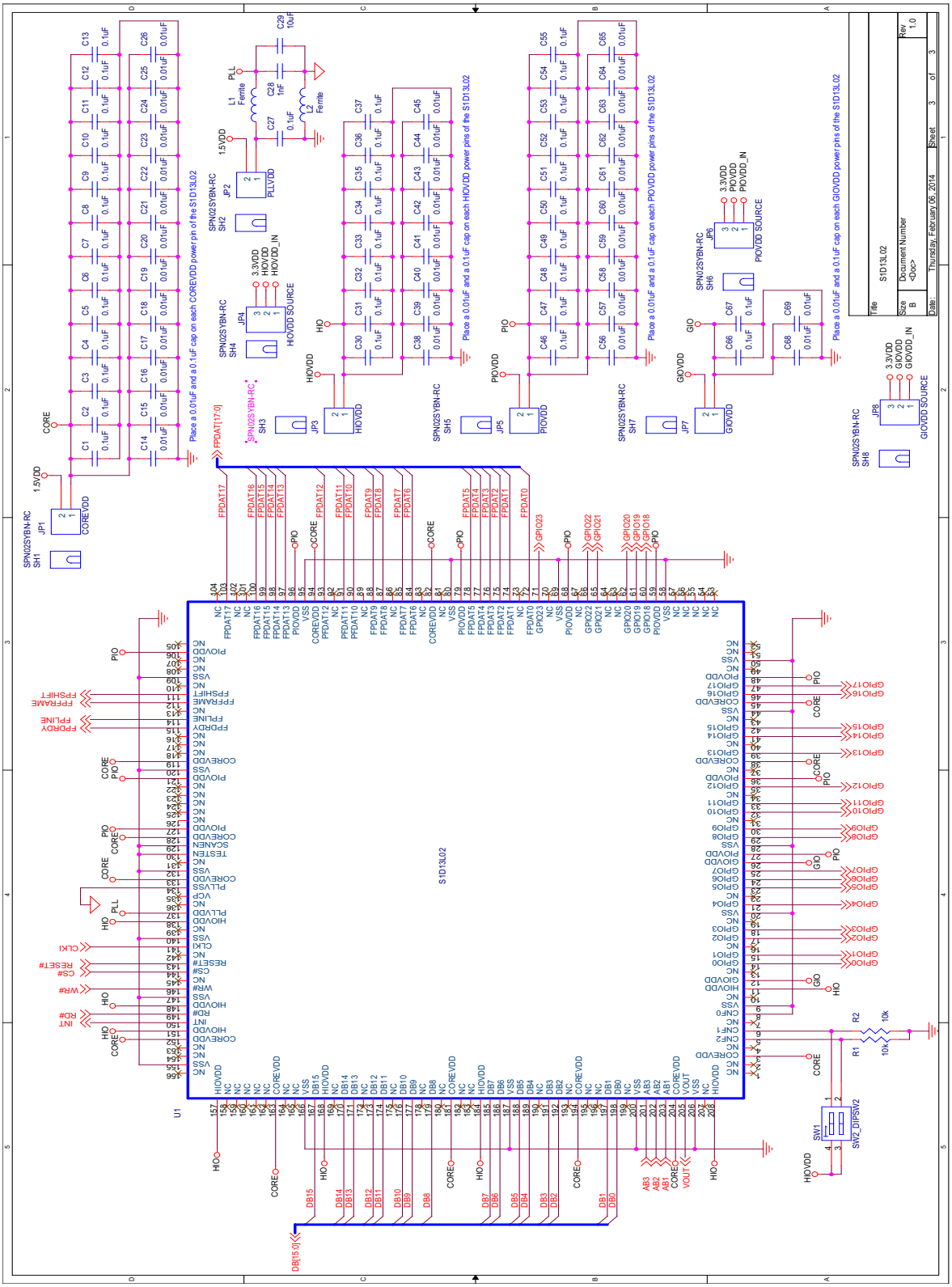

Figure 6-3: S5U13L02P00C100 Schematics (3 of 3)

Chapter 7 Board Layout

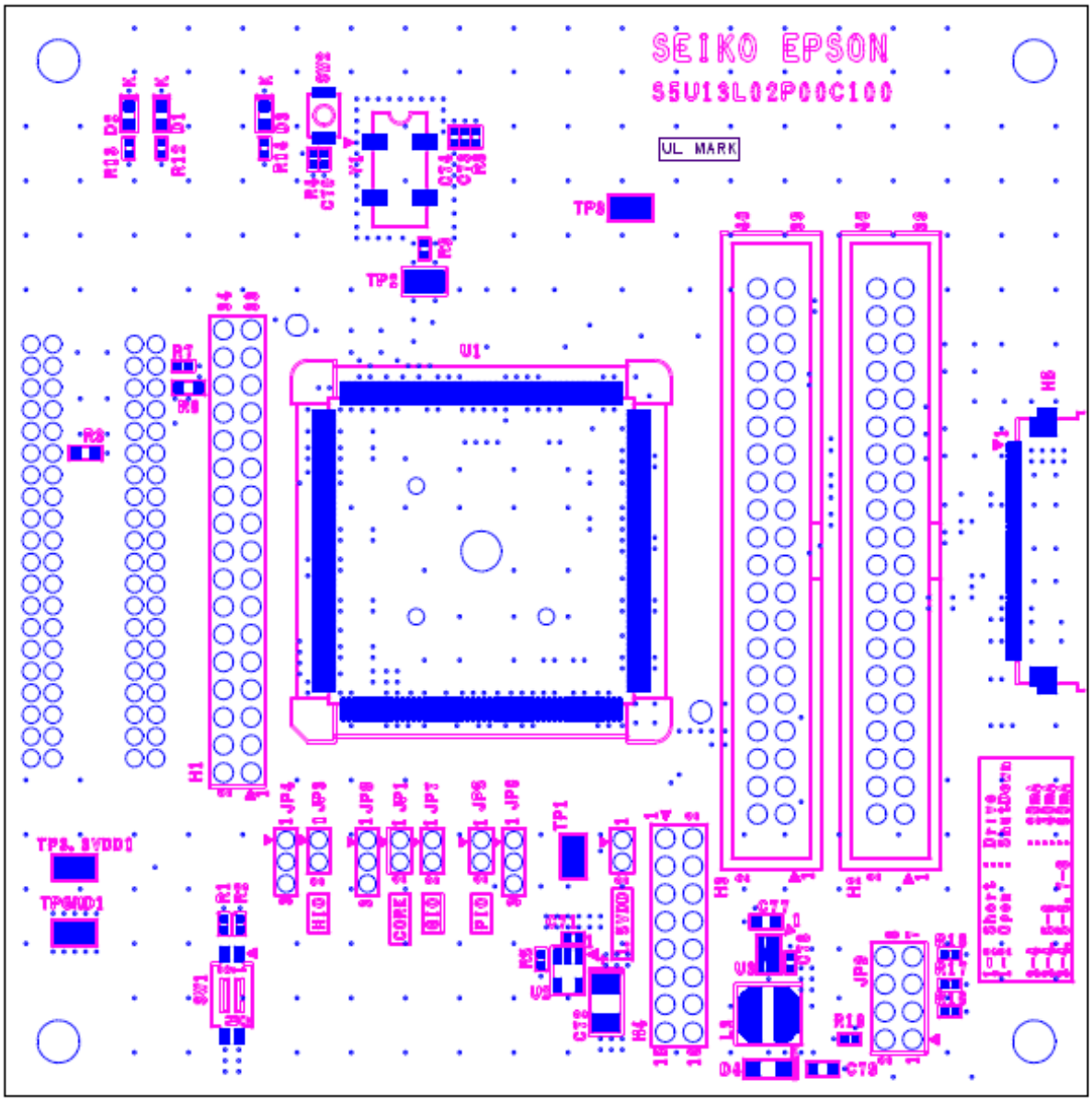

Figure 7-1: S5U13L02P00C100 Board Layout - Top View

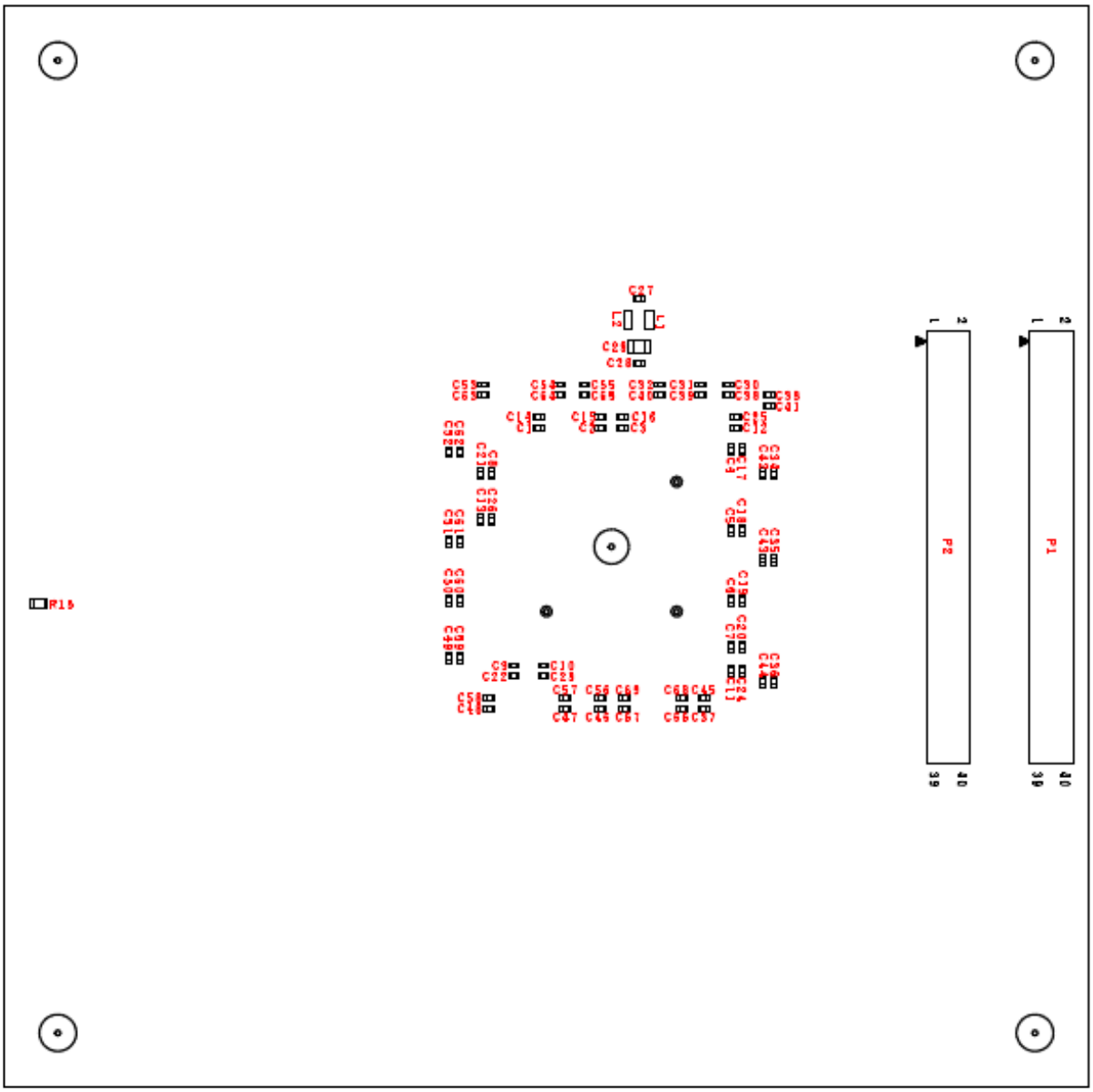

Figure 7-2: S5U13L02P00C100 Board Layout - Bottom View

Chapter 8 References

8.1 Documents

- Epson Electronics America, Inc., *S1D13L02 Hardware Functional Specification*, document number XB0A-A-001.

8.2 Document Sources

- Epson Electronics America Website: http://vdc.epson.com.

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